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# **MINKS: Diseases and Parasites**

**AGRICULTURE HANDBOOK  
NO. 175**



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AGRICULTURAL RESEARCH SERVICE  
U.S. DEPARTMENT OF AGRICULTURE  
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# X MINKS: Diseases and Parasites X

By J. R. Gorham, H. J. Griffiths, and R. Keith Farrell.

Domestic raising of minks on a large scale is a relatively new industry in the United States. Although minks were grown on farms as early as the 1920's, rapid expansion of the industry did not occur until introduction of the mutation strains in the early 1940's. More than 6,500 domestic mink ranchers now produce more than 5 million pelts annually. The industry has an annual value in excess of \$100 million.

Increasing production costs emphasize the importance of reducing

to a minimum losses from diseases and parasites.

This bulletin, based on nearly 15 years of research by Federal and State agencies and by the fur-farming industry, is intended to provide a useful reference manual for mink ranchers. It is designed to help ranchers recognize the more common mink diseases and thus know when professional assistance is needed. It is not meant to encourage ranchers to diagnose and treat diseased minks without the advice of a veterinarian.

## DISEASES OF MINK <sup>1</sup>

Diseases are here divided according to their cause—bacteria, viruses, nutrition, heredity, and miscellaneous, including poisoning and vices such as tail chewing.

Consult a veterinarian for specific information if a disease breaks out in your mink herd. There is always the possibility that an animal may be suffering from two or more diseases at one time.

### Factors in Prevention and Control

#### Ranch Location

The ranch may be located on any type of well-drained soil. Good

drainage, as in gravelly or sandy soil, helps to lower the incidence of disease; poor drainage favors the growth and spread of bacteria and parasites. Good soil drainage is especially important if minks are kept on the ground. Although the importance of good soil drainage is reduced if minks are reared in wire-bottom pens, it is not good practice to allow pools of stagnant water to accumulate under the pens.

When selecting a location for a ranch, consider the possibility of losses due to heat exhaustion. Minks get along very well in cold weather, but they do not tolerate extremely hot, humid conditions. As many desirable mink-raising areas are hot and humid, locate the ranch where there is a maximum of air circulation. Good ventilation often prevents losses.

<sup>1</sup> Prepared by J. R. Gorham and R. Keith Farrell, Animal Disease and Parasite Research Division, Agricultural Research Service, in cooperation with the Department of Veterinary Science, Washington State University.

## Shipping Instructions

Ship only animals that have been vaccinated against distemper and virus enteritis. For convenience in feeding and handling during shipment, expressmen often place minks next to dogs. If the dogs near them have distemper, unvaccinated minks run a serious risk of becoming infected.

Proper feed and clean fresh water during transit are very important. In the feeding instructions to the expressman, specify the use of freshly ground, raw lean beef, but never hamburger. Use of hamburger permits too many substitutes that may be spoiled or decomposed. Feeding of spoiled hamburger has caused the loss of valuable animals. Fresh water should be available to the minks at all times.

Isolate all new or returned breeding stock. Place them in a separate shed for at least 50 days. Animals should be shipped only during the fall and winter and never before the breeding season, when an isolation period is impracticable.

## Live Animal Exhibitions

Live animal fur shows and field days are worthwhile and should be continued at their present high standards. If a few precautions are followed, the danger of disease is negligible. Vaccinate all show animals for distemper at least 2 weeks prior to the exhibition. Do not show any minks if any animal on your farm has had distemper within the past year. Minks from virus enteritis areas should be barred from shows until effective control measures become available.

## Pens and Nest Boxes

Wire-bottom pens have greatly reduced the hazard of disease (fig. 1). Because internal parasites (such as coccidia) and external parasites (such as fleas) spend parts of their life cycles in bedding or soil, animals readily reinfect themselves



FIGURE 1.—A mink pen of desirable type. It is raised above the ground so that the droppings cannot collect in the pen but will fall down through the wire.

and expose their pen mates when they are kept on the ground. Furthermore, infected soil remains contaminated for some time and is capable of infecting minks that are later placed in the pen. Pens with cement or board floors have the same disadvantages. However, they are easier to clean and disinfect.

Nest boxes and pens should be constructed so that they are easy to clean. Pelt in season any animals that are poor housekeepers—as evidenced by piles of droppings and uneaten feed—unless they are valuable breeders. This filth is a source of disease-producing bacteria, bacterial toxins (poisons), and parasite eggs and cysts, and, in addition, it attracts flies, which may carry bacteria and viruses.

## Guard Fence

A guard fence is important to prevent loss of animals that escape from their pens and to keep out stray dogs, rats, and other animals and visitors that might introduce infection into the minkery.

Many mink ranchers keep dogs within the guard fence to protect the minks from marauders. This is permissible if the dogs have been vaccinated for distemper and are not allowed to roam the neighbor-

hood, where they might be exposed to it or to other diseases and carry them back to the stock animals. Rats are potential spreaders of a large number of disease-producing organisms; they should be eliminated from the premises to protect the health not only of the minks but also of the workers and their families.

It is not good practice to allow ferrets, pet coyotes, or raccoons, in the enclosed area. All these animals are susceptible to distemper and, if infected, can easily spread the virus. In a routine mink-vaccination program, all such pets should also be vaccinated.

### Water and Feed Supply

Successful ranchers realize the importance of plenty of fresh water for their minks. The mink's natural habitat is near lakes and along streams and rivers. Minks can occasionally miss a feeding or two without harm, but they must have water every day. Withholding water for about 3 days will kill a mink. Under farm conditions, 1 day without water is likely to be fatal.

Many ranchers have a watering system in which all minks on one side of a shed drink out of one long, narrow trough. Since distemper virus is excreted in nasal discharges and virus enteritis is excreted in the droppings, one infected mink near the source of water might easily infect all those drinking along the entire row. Always provide individual water containers when there is a disease outbreak.

Using any feed of questionable quality is unwise. For example, meat containing botulinus toxin would produce botulism, which can wipe out an entire mink herd within 2 or 3 days. Never purchase meat from a rendering plant; it may be contaminated or spoiled by improper handling or inadequate storage facilities.

### Disinfectants

Cleanliness in the care of minks cannot be overemphasized. A disease is much easier to prevent than to cure. Minks are hearty, vigorous animals. They rarely get sick if they have an adequate ration and healthful living conditions.

To facilitate the use of disinfectants, all equipment and other construction should be as simple as possible and easy to clean.

Fecal matter and other organic material protect disease bacteria and viruses; therefore, thorough cleaning should precede disinfection. It is advantageous to have one agent act as both cleanser and disinfectant.

In the routine cleaning and disinfecting of pens and sheds on a small ranch, ordinary lye solution is effective and economical. One 13-ounce can of lye is enough to make 15 gallons of cleaning and disinfecting solution. For large ranches, it is advisable to buy the lye in the form of caustic soda. Each pound makes about 20 gallons of solution, which does not need to be heated although heating is advisable. In addition to acting as a disinfectant, lye cuts grease and partly dissolves and penetrates fecal material.

Use of lye has some disadvantages. Concentrated lye is a poison and is destructive to aluminum paints, and clothing. The dilute solution recommended does not harm wood or iron, nor is it harmful to the animals in the amounts that might remain in the pens. However, do not leave the solution where the animals may drink it. The lye may be slightly irritating to the hands and face of the operator. Consequently, take precautions to avoid excessive exposure of the skin during the disinfecting process. Keep containers of lye tightly covered.

Many ranchers use steam under pressure to clean and disinfect pens and equipment. The steam is sup-

plied by a steam jenny, which uses oil as fuel. When steam is used, it is a good idea to first soak the caked fecal material with water. Use of a good cleansing compound in the jenny boiler cleans and disinfects very satisfactorily.

Use of cresol compounds on fur farms is not recommended. Severe inflammation of the feet of adult minks has been reported as a result of their use. One farmer who sprayed the inside of his nest boxes in the fall lost a large number of kits the following spring. Enough of the material soaked into the wood to burn the young minks so severely that they died. Cresols have a disagreeable odor and do not mix readily with hard water.

Although hot water alone is used to clean feed houses and feeding equipment on many successful fur farms, some of the cleansing agents, or detergents, do a better job. If bought from a distributor, they are cheap enough for use on the fur farm. Their disinfective action is limited, but they are effective in cutting grease and in general cleaning. Routine use of these compounds on the mink ranch is recommended.

### Disease Outbreaks

When disease breaks out, immediately isolate the affected minks from the rest of the herd. Clean and disinfect all pens, nest boxes, and feeding and other equipment with a 2-percent lye solution (1 pound of lye to 5½ gallons of water). This solution is effective against most viruses and bacteria; however, for anthrax, use a 5-percent solution (½ pound of lye to 1 gallon of water). In using lye solutions, especially in strong concentrations, care should be taken to prevent injury to both the operator and the animals.

Cleanliness and care in avoiding contact with infection are always necessary, even when new disinfect-

ants are available. Any accumulation of dirt protects bacteria and nullifies the effectiveness of even the most efficient disinfectant.

### Disposal of Dead Animals

Every ranch loses a few animals each year. If the animals are not submitted for autopsy, they should be disposed of in such a way that they will not infect the rest of the stock. To "throw them over the fence" is a dangerous practice, as rats, dogs, and flies may carry the disease back to the minks. Probably the most efficient and sanitary method of destroying carcasses is to burn them.

Also, burn pelted carcasses or sell them to rendering plants. Never feed them to the animals. The diseases and parasites that might be spread through an entire mink ranch are too numerous and damaging to justify the risk of infection for the small amount of meat obtainable from the carcasses.

### Bacterial Diseases

#### Botulism

The botulism bacterium *Clostridium botulinum*, in the absence of oxygen, produces a potent toxin in contaminated meat. If an outbreak of botulism occurs in a mink herd, losses are very high. In an outbreak involving 13,000 minks near Seattle, approximately 6,000 minks died.

*Signs.*—From 12 to 96 hours after minks have eaten meat containing the toxin, some dead and some paralyzed minks will be found in the pens. Onset of the disease is rapid. It is characterized by muscular incoordination and stiffness followed by paralysis of the front or hind legs. When the animal is picked up and held over the palm of the hand, the front and hind legs hang limp (fig. 2). The eyes are bright and salivation is common.



FIGURE 2.—When a mink affected with botulism is picked up, the front and hind quarters hang limp.

The toxin paralyzes the muscles used in breathing, and the minks die.

*Prevention.*—Never feed the carcasses of sick animals, spoiled feed, or feed that has had a chance to become warm. Always keep the mix cool before feeding. If you are not sure about a certain food ingredient, feed it to a few animals before including it in the regular ration. However, the best practice is to follow the axiom “when in doubt—throw it out.”

For prevention, a toxoid—preventive inoculation—offers excellent promise. The first work on botulism toxoids for minks was done in Sweden. Following disastrous outbreaks of botulism in this country when spoiled meat was fed, research workers in Utah and Wisconsin and at the Department of Agriculture Fur Animal Disease Station developed an experimental toxoid, which is available commercially. Vaccinate all kits shortly after weaning.

*Treatment.*—Treatment of minks affected with botulism is seldom successful. Prompt recognition and report of the disease when it first appears gives the veterinarian

a better chance to save minks that have not eaten enough of the poisoned feed to show signs. Immediately remove from the wire or feed boards and discard any feed you suspect is spoiled.

If the veterinarian makes a diagnosis of botulism, polyvalent antitoxin should be administered to every mink on the ranch as soon as possible. The dosage should be from 5 to 10 cubic centimeters, depending on the size of the animals.

## Anthrax

Anthrax is an acute infectious disease caused by the bacterium *Bacillus anthracis*. Minks become ill by eating infected horse, cattle, or hog meat.

*Signs and autopsy findings.*—Within a day or two after eating infected meat, minks often show the following signs: Depression, loss of appetite, and finally muscular weakness and death. Autopsy reveals engorged blood vessels filled with black, tarry blood. The spleen is enlarged, dark red, and easily torn. A diagnosis can be made only by bacteriological examination, because other conditions in minks often present a picture similar to that of anthrax.

*Prevention and treatment.*—Obviously, the best prevention is to feed no meat from animals that were sick before slaughter. A veterinarian who diagnoses anthrax in a mink herd usually prescribes penicillin or some other antibiotic.

Man is also susceptible to anthrax. Therefore, burn dead animals; do not pelt them. It is very easy to become infected through the hands and arms by handling animals that have died from anthrax. The bacteria are highly resistant to heat and drying and can live for years on dried material and in soil. Do not market pelts from minks that die of anthrax; they may infect anyone who handles them.

## Streptococcus Infections

### ABSCESSSES

An abscess (boil) is an enlargement due to an accumulation of pus enclosed in a capsule. Abscesses are usually sporadic in occurrence and do not cause much concern. However, on a ranch where a large number of minks have abscesses that resist treatment and many of the animals die, the problem is not so simple.

*Cause.*—Abscesses usually are caused by slight injuries to the skin or lining of the mouth by slivers of bone or wood or bits of sharp material in poor-quality nest hay. These injuries allow streptococci and a variety of other bacteria to enter. Abscesses develop from the infection.

Faulty techniques used in vaccinating may cause an abscess. All vaccination programs should be supervised by a veterinarian. If the vaccine becomes contaminated with bacteria, each inoculated mink will have a large abscess within 5 or 6 days.

During the breeding season, aggressive males frequently bite the females. The resulting wounds often become infected, and abscesses result.

Bacteria also may be introduced in the feed. Eating meat from a horse affected with fistula of the withers or with strangles may cause an outbreak of abscesses among minks.

*Signs and autopsy findings.*—Until an animal is near death, its appetite remains good. The affected animal can be easily picked out by its misshapen head or neck (fig. 3). After an abscess breaks, a crust may form a cap over the animal's head. Such a case is difficult to treat. Unless a mink so affected is a valuable breeder, pelt it in season.

The mink with an abscess usually has a greatly swollen, dark-red

spleen. The liver is sometimes dull red, soft, and easily torn. Sometimes small abscesses are scattered through the organs.

*Treatment.*—After the abscess has come to a head, as evidenced by a hot, painful, fluctuating swelling, make a vertical incision with a



FIGURE 3.—Adult mink with an abscess in its throat. Some of the fluid has been taken up in the syringe.

sharp, sterile knife at the lowest point of drainage. Make the incision large enough to allow the pus to flow freely. Then wash out the cavity with a mild antiseptic and sprinkle it with a good healing powder. Your local veterinarian can demonstrate this simple technique. It is well to accompany the treatment with injections of penicillin.

### SEPTICEMIA

The term septicemia refers to an infection in which bacteria enter the blood stream, multiply, and produce toxins. Streptococcal septicemia is a disease of young minks at about weaning time. The usual history is sudden death of one kit of a litter. Separate the balance of the litter and inoculate each kit with penicillin.

### SINUSITIS

Inflammation of the nasal sinuses is occasionally seen in minks. The animals may have a nasal discharge for 3 or 4 months. In this disease,



as in others in which a nasal or eye discharge occurs, distemper must first be eliminated as a cause of the discharge before other diagnoses can be made.

#### CELLULITIS

Ranchers first note this condition when a mink refuses feed and appears sluggish. Within a short time its head begins to swell. The swelling caused by cellulitis differs from the swelling caused by abscesses. In abscesses, the inflammation is usually confined to the side or top of the head. In cellulitis, the inflammation covers the entire surface, including the top and sides of the head, the nose, throat, and adjoining neck region. Here the swelling stops, and a raised edge circling the neck can be felt. This edge of the swelling is a distinctive feature of the disease. Eyes may be clear or they may show a discharge. Lids are swollen.

Cellulitis may easily be confused with distemper, in which a swollen head and eyelids and an eye discharge are commonly observed. To differentiate between the two diseases, an examination by a veterinarian or a diagnostic laboratory may be necessary. In cellulitis, cutting the skin of the head releases a thin watery fluid. Opening abscesses reveals a thick exudate that is never clear. Streptococci can be isolated from the exudate. Other post-mortem findings are not significant. In hydrocephalus the head is also swollen, but the swelling is caused by a large amount of fluid within the skull cavity.

#### Salmonella Infections

Fur-farming journals often mention *Salmonella* organisms as the major cause of enteritis (inflammation of the intestines) in minks. Minks with diarrhea are frequently said to have a *Salmonella* infection. Such diagnoses are often made without laboratory confirmation.

The agents leading to or causing enteritis in minks are largely unknown. Other causes of enteritis may be nutritional or from virus infections.

In one unusual outbreak among pregnant females, the predominating sign was abortion; no deaths occurred. *Salmonella* organisms were isolated from the uterus and from aborted kits in every instance. The original source of infection was infected pork livers.

#### Tularemia

In some sections of the West, jackrabbits often are numerous enough to use as a substitute for horse meat in mink rations. Tularemia (rabbit fever) is a common disease of jackrabbits; it has been reported from all parts of the United States. Snowshoe rabbits, cottontails, and many other rodents also may carry the disease, and man may contract it.

Examination of a rabbit or mink infected with tularemia often reveals many small white spots on the surface, and imbedded in the substance, of the liver, spleen, and lungs (fig. 4). However, a rabbit may carry the bacteria and show no changes in the organs.

To prevent tularemia in minks, do not feed them sick rabbits or rabbits that have a spotted liver and

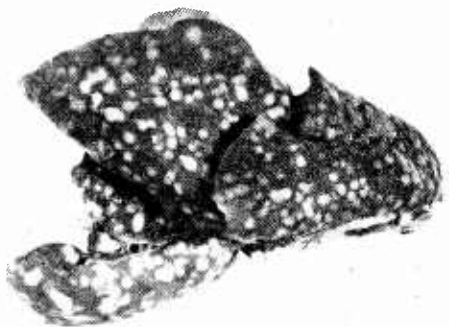


FIGURE 4.—Lungs from a mink that died of tularemia; the white spots are typical of the disease.

spleen. Furthermore, when rabbits are decreasing in numbers in an area, do not feed them to minks; they may be dying as a result of an outbreak of tularemia. Adding an occasional wild rabbit to the ration is very poor practice. The amount of meat obtained is small and the risk is great.

Outbreaks can be controlled by including in the regular ration a treatment level of a broad-spectrum antibiotic such as Aureomycin or Terramycin. An affected animal may be given an injection of Streptomycin. However, this antibiotic is very toxic to minks and should be used with care.

Tularemia bacteria that may enter the body through a wound, cut, or abrasion, or directly through unbroken skin may cause tularemia in man. It is important, therefore, that skimmers and others handling rabbit carcasses wear rubber gloves, even though the disease is not suspected. The bacteria have been found in carcasses 133 days after death, and in hides as long as 40 days. However, the bacteria are killed by thorough cooking of the infected tissue.

## **Tuberculosis**

Tuberculosis, one of the most common diseases in minks in Europe, is rare in minks in the United States. Regulatory agencies, both Federal and State, have largely controlled the disease in livestock, which is a source of protein for minks in this country.

As the signs shown by live infected minks are not characteristic, the disease is usually recognized only at autopsy. When the animal is opened for examination, the spleen and lymph nodes may be greatly enlarged. Gray spots are often seen in the substance of the spleen. The diagnosis is confirmed by bacteriological procedures.

No practical herd treatment has been found. Avoid feeding in-

fectured pork, chicken, or beef byproducts.

## **Nonspecific Enteritis**

An enteritis of which the definite cause is unknown frequently affects minks. It may be bacterial in origin, or it may be caused by a virus. It is useless to speculate as to the cause until more facts are known. The disease usually breaks out in warm weather on ranches where sanitation is not good. The feed house is often dirty, the meat grinder seldom cleaned, and refrigeration poor. Uneaten feed remains on the wire or feed boards, and old feed and feces are piled up in the nest boxes. These practices foster the agents that cause enteritis and often lead to and cause a severe outbreak. However, enteritis may also appear at times on clean, well-managed ranches.

*Signs.*—The signs vary. In acute cases, a mink may refuse to eat, have bloody diarrhea, and die within 3 or 4 days. In chronic cases, the animal may not die for a month, during which time it often has an excellent appetite. However, it apparently does not digest its food, and it becomes badly emaciated before death. In some cases of chronic enteritis, the feces are light in color and mixed with mucus; in other chronic cases, the feces are black and fluid.

*Autopsy findings.*—Contrary to popular opinion, enteritis is often difficult to diagnose at autopsy. The carcass must be fresh, for if the mink has been dead for even a short time, post-mortem changes (changes occurring after death) mask changes due to the disease and make it impossible to diagnose the cause of death. This is particularly true in the intestinal tract, where the walls are rather thin and quickly become blackened. The intestinal lining breaks down shortly after death, and the intestinal contents become black and

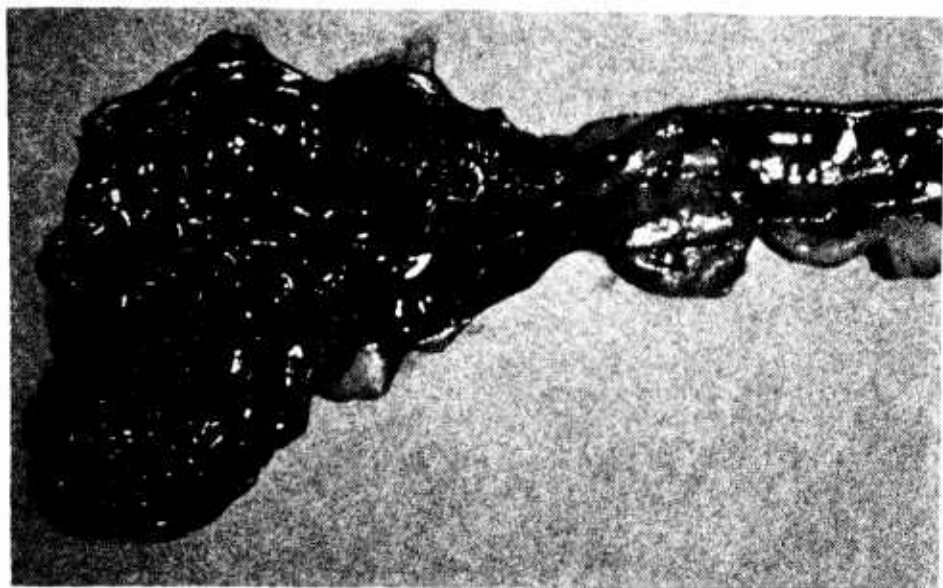


FIGURE 5.—Acute inflammation of the stomach and adjoining part of the intestine, which darkens the lining.

fluid. This quickly covers up the changes due to enteritis.

If the mink has been dead only a short time and the intestine is red-dened and contains free blood, acute enteritis (fig. 5) evidently was the cause of death. If the wall is thickened and the animal has had intermittent diarrhea for some time, chronic enteritis is a safe diagnosis. Stomach ulcers are commonly observed.

*Treatment.*—A veterinarian who diagnoses enteritis in a herd will prescribe drugs to alleviate the inflammation of the intestines of the affected animals and to combat the infection. Sulfaguanidine can be used to advantage by including it in the feed.

## Pneumonia

*Pasteurella multocida* is found in cases of mink pneumonia. The disease often appears in the spring and fall when the weather is damp and the temperature is subject to rapid change. Nest boxes should be constructed so that they can be kept dry and well ventilated. Minks can stand freezing tempera-

tures, but they cannot tolerate wet nest hay and boxes.

Rapid, shallow breathing, as evidenced by a heaving of the flanks, is the most important clinical sign of the disease.

For treatment, injections of penicillin, Aureomycin, or Terramycin can be given. Treatment is not always successful because the animal is often too far gone by the time it looks ill.

*Pseudomonas aeruginosa* causes a rare but deadly pneumonia in minks. This bacterium is introduced into the herd through contaminated drinking water. Most minks are noticed to be sick only an hour or two before they die; they may look healthy in the evening but are found dead the next morning. Affected animals usually bleed from the nose. Dark-red congested lungs are the most significant finding at autopsy.

Streptomycin and polymyxin are the antibiotics of choice. However, these drugs are highly toxic to minks; information as to the dosage and manner of treatment

should be obtained from a veterinarian.

## Pleuritis

Pleuritis (inflammation of the lining membranes of the chest cavity) causes sporadic deaths in a mink herd. Cutting the ribs and opening the chest cavity reveals a large amount of thick, grayish-yellow pus. The lungs are compressed and covered with adhesions.

Animals sick with pleuritis are seldom treated, because they usually are found dead with no signs of illness.

## Virus Diseases

### Distemper

When distemper is mentioned, mink ranchers everywhere have cause for alarm, for it is a very serious disease in minks throughout the United States.

Although almost all minks become infected in any given outbreak, some animals do not show any signs of the disease. Deaths vary in number from one outbreak to another. Losses may be as high as 90 percent in young minks, but average 30 to 40 percent in older minks. Kits as young as 3 weeks may be infected. Outbreaks occur at any time of the year.

*Cause and transmission.*—The cause of distemper in minks is a virus—the same virus that causes distemper in dogs and foxes.

Although the distemper virus is easily destroyed within a few hours by heat and by most of the common disinfectants, it resists drying and low temperatures for several weeks. It can survive for some time at temperatures below freezing.

The virus is spread from animal to animal through the air. In normal breathing, minks that show distemper (as well as apparently healthy carriers) emit millions of small, virus-containing droplets into the air. Shortly before and during an attack, the virus also is

found in the saliva, nasal secretions, and skin scurf. A mink may also shed the virus into the air after signs of the disease disappear. The virus can also be transmitted among minks by indirect means, such as contaminated handling mitts and food pans.

*Signs.*—A mink infected with distemper often has signs resembling those of other mink diseases. In a disease outbreak, consider first the possibility of distemper.

The incubation period—the interval between the time the virus first enters the mink and appearance of the disease—is about 9 to 14 days.

The first sign of the disease is squinty, swollen watery eyelids. In 2 or 3 days the lids become crusty and stick together (fig. 6). A similar discharge appears at the nostrils, where it dries and cakes. The mink may have an excellent appetite at this time. The head is often swollen. These signs, which may persist for a week or more, usually are accompanied by a swelling of the foot pads. Later examination reveals granular material on the swollen red surfaces of the pads (fig. 7).

Thickening of the skin and loss of hair are not uncommon. At this time, the mink may go into a coma and die in a terminal convulsion. However, it may recover, the signs of the eye, nose, and feet meanwhile subsiding. Although it has



Figure 6.—Mink showing signs of distemper; the lids are stuck together with a pussy discharge.



FIGURE 7.—*Left*, Footpad of a healthy mink. *Right*, Footpad of a mink with advanced distemper showing swelling and, on the surface, a granular material that adheres to the skin.

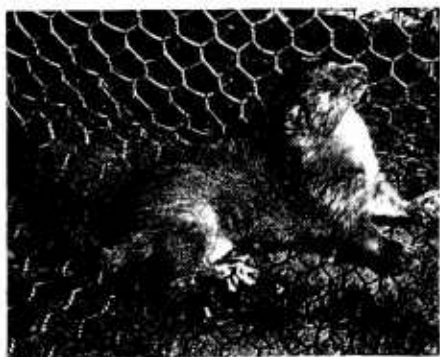


FIGURE 8.—Neurotropic signs in a distemper-infected adult; the head is thrown back in a violent spasm.

a good appetite and appears normal, a mink may later die in what ranchers term "screaming fits." In this type of distemper, the virus has invaded the brain, causing the mink to froth at the mouth, chew violently on the wire netting, roll about the pen, and scream sharply (fig. 8). These convulsive seizures may last a short or a long time. The mink usually dies after one or two attacks.

*Autopsy findings.*—Distemper is difficult to diagnose by looking at the lungs and the abdominal organs. Frequently, the only change that can be seen is an enlarged spleen. Important changes are observed, however, if a piece of bladder or trachea (windpipe) is stained with dyes and examined under the microscope. Distemper leaves characteristic marks, called inclusion bodies, in those tissues. They are small stained "dots," or specks, which represent distemper virus.

The surest way for a veterinarian to obtain a diagnosis is to remove the spleen from the suspected distemper-infected mink, grind it in a liquid suspension, and inject it into a ferret. If the spleen contains active virus, the ferret, which is almost 100 percent susceptible to the virus, will become infected.

*Prevention.*—Distemper is usually introduced into a herd of sus-

ceptible minks by new breeding stock that carry the virus or by an infected dog. On many isolated farms where the source of the virus is not apparent, some insect or an animal other than a dog might act as a carrier of the virus.

As preventive measures, isolate new breeding stock for at least 50 days and take special care to allow no infected dog near the minks. Anyone who raises minks should learn to recognize typical signs of distemper in the dog, which are as follows: An irregular fever, dullness, loss of appetite, and a discharge from the eyes and nose (fig. 9). The discharge at first is thin and watery; later it becomes thick like mucus and tends to dry in crusts around the eyes and nose. If the lungs and air passages are affected, the dog coughs and has difficulty in breathing. In some cases, the skin has small red pustules; in others, diarrhea occurs.

As in minks, the nervous form of the disease may appear in the later stages. A dog may have an almost continuous twitching of one leg, the forehead, or ears, a blinking of the eyes, or a champing of the jaw. The animal usually has intermittent convulsions and may become paralyzed. Death follows the appearance of these nervous signs in half or more of the cases. Dogs that recover are often left with permanent brain or nerve-tissue damage. However, the signs are not always so severe; the animal may have only a slight eye discharge and not feel up to par. Nevertheless, it is still capable of transmitting the virus. A few dogs that have apparently recovered from an attack of distemper may be carriers and potential spreaders of the virus for a short time.

Despite marked progress in immunizing minks against distemper, the virus causes heavy losses each year. Two general types of distemper vaccine are on the market—killed-virus vaccine and living



FIGURE 9.—A young dog showing typical signs of distemper—discharge around the eyes and nose.

modified virus vaccine. Killed-virus vaccine is safe to use but has some disadvantages. Animals inoculated with this type of vaccine develop immunity rather slowly. The immunity seems to leave the animal, and revaccination is necessary.

Living-virus vaccine, prepared in fertile hen eggs, has been more successful in controlling outbreaks. Since this modified virus must be living at the time it is administered, ranchers should obtain the advice of a veterinarian before they use it. For example, if the reconstituted vaccine becomes warm or disinfectants are used in the syringes, the vaccine may not have any effect. For maximum control, all kits should be vaccinated at 10 weeks of age.

*Treatment.*—Unless an early diagnosis is made and the infected animals are isolated, control of outbreaks is often unsatisfactory. In an outbreak, isolate each mink as it breaks out with distemper and vaccinate the other animals in the herd. Do not handle or shift animals more than necessary, as such manipulations may spread the virus through the pens. Effective treatment of an animal with screaming fits (neurotropic distemper) is impossible. The virus has caused irreparable damage to its nervous system.

## Virus Enteritis

Virus enteritis, a serious threat to minks in the United States, was first recognized in Ontario and has been reported in many mink-raising areas of the United States. The disease spreads rapidly on a ranch and may kill up to 75 percent of the kits.

The first indication of sickness, a sudden loss of appetite, occurs within a week after the minks are exposed to the disease. A slightly pink to grayish-white "slug" (intestinal cast) can be noticed in the feces. Animals that do not die within 4 or 5 days often recover but may never reach maximum size. At autopsy, the intestines appear bright red.

Pelt in season minks that have recovered from virus enteritis. They may harbor the disease as "silent" carriers and serve as a source of virus for kits the following summer.

Because virus enteritis is related to feline-panleukopenia virus, cats as well as other animals and visitors should be excluded from mink yards.

Two types of vaccine are used to immunize minks against virus enteritis. One type is a killed-virus vaccine prepared from the spleen of mink dead of virus enteritis; the other is commercial formalized feline-panleukopenia vaccine.

## Nutritional Diseases

### Urinary Calculi

Urinary calculi, commonly called stones or gravel, are deposits of mineral salts in the kidneys, bladder, and urethra (the tube from the bladder to the outside) of minks. Losses of male kits have exceeded 10 percent on a single ranch. In females, it is most prevalent in May and June, with losses in excess of 15 percent on some ranches.

The cause is unknown. The stones are almost pure magnesium

ammonium phosphate. Because calculi of this type are thought to form in alkaline urine, investigators believe this alkalinity has a role in the disease.

*Signs and autopsy findings.*—The signs of calculus disease are often difficult to recognize and the presence of calculi in the animal may not be known until an autopsy is made. Sometimes the signs are weakness, difficult urination, wet fur between the hind legs, straddling gait, paralysis, and terminal convulsions followed by death. A diseased animal is often in good flesh because its appetite remains good until death. Sometimes, however, its hair coat becomes rough and it refuses food, thus losing flesh before dying.

In female minks, calculi often hinder normal contractions of the uterus and prevent birth of the kits.

At post-mortem examination, the kidneys and bladder should be examined for calculi (fig. 10). Where calculi are present and have caused the death of the animal, the stones are usually accompanied by blood and pus. Calculi range from the size of a millet seed or smaller to a size that fills the entire bladder. In male minks, a very small calculus may lodge in the urethra at the penis bone (fig. 11) or where the urethra curves around the pelvis bone. In these cases the bladder is often filled with bloody fluid.

Calculi apparently form rapidly. Large ones have been found in bladders of kits 6 to 7 weeks of age.

*Prevention.*—Observations indicate that feeding phosphoric acid from the first of April through pelting may help control the disease, because the drug helps to establish

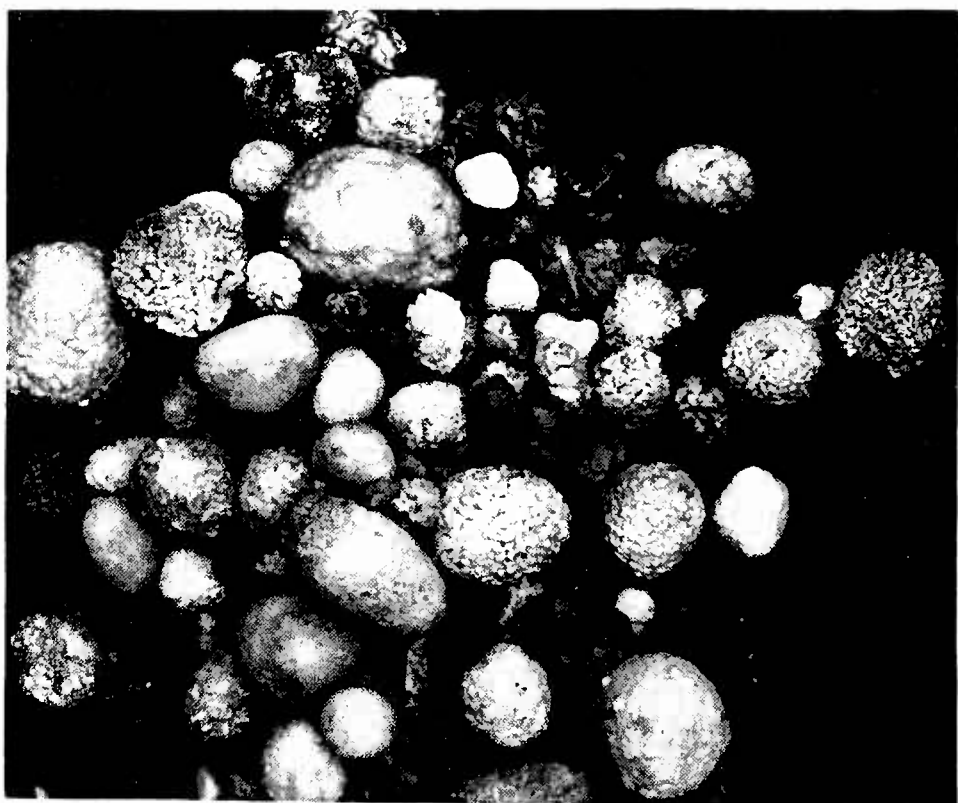


FIGURE 10.—Calculi removed from urinary tracts of minks.



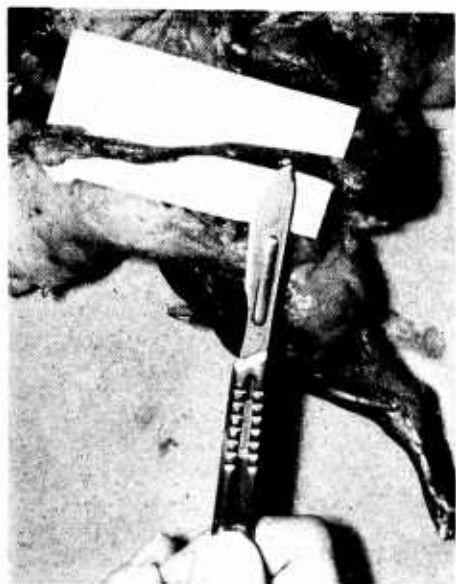


FIGURE 11.—A small calculus lodged in the tube at the penis bone.

a more neutral urine. The animals should be given plenty of water.

### Steatitis (Yellow Fat)

Steatitis, a summer-fall disease that affects young minks only, has been recognized in various parts of the United States and Canada since 1942. It probably existed before that time but was diagnosed as something else. Losses from steatitis have amounted to thousands of dollars on some ranches.

*Cause.*—The disease usually appears when ranchers feed a high percentage of horse meat that has been in storage, or fish scrap. Such rations often have a high content of unsaturated fatty acids and are low

or deficient in vitamin E. Observations of natural outbreaks and laboratory experiments have shown that these two factors probably work together to produce the characteristic yellow-brown color of the fat.

*Signs.*—Kits are first affected shortly after weaning and after they have eaten large amounts of solid food. Outbreaks are most common the last 2 weeks in July and the first 2 weeks in August. Some, however, begin late in September and continue until pelting time.

Steatitis usually appears without warning. Some kits may refuse the night feeding and be dead in the morning. Others may leave their feed and show a peculiar unsteady hop. The impaired gait may become progressively worse until the minks are unable to move. They remain in a coma until death. In a typical outbreak, 25 percent of the kits may die; often the survivors do not fur out well. Nearly all the kits that survive show yellow discoloration of the fat and skin at pelting time (fig. 12).

*Autopsy findings.*—At autopsy, the abdomen and groin appear thickened and feel doughy. When the affected tissues are cut with a knife, a thin watery fluid escapes. The fat beneath the skin and surrounding the abdominal organs is a characteristic brownish yellow. The spleen is often 2 to 3 times normal size and may have dark blotches on it.



FIGURE 12.—Discolorations on a pelt caused by steatitis in a mink kit.



FIGURE 13.—This female, affected with nursing sickness, is very thin and weak.

*Prevention and treatment.*—Because the disease often closely follows weaning, feed the female, as well as the kit, a ration adequate in vitamin E and other nutrients. Supplement the diet of young growing kits so that the amount of wheat-germ meal or stabilized powder provides 5 units of vitamin E per day per mink.

In an outbreak, reduce the amount of fish or storage horsemeat in the ration; substitute fresh unfrozen horsemeat and liver and add wheat-germ meal or stabilized vitamin E powder to the diet. Inoculate each affected kit with 15 to 20 milligrams of vitamin E a day for 3 days or more. The preparation is sold under such names as injectable tocopherols.

### Nursing Sickness

Nursing sickness, common in nursing minks, appears before the 5th or 6th week of lactation. Affected females are first noticed in late June at about the time the young minks are weaned, but the disease may appear after the kits have been taken away.

Signs of nursing sickness include lack of appetite, loss of flesh, weak-

ness, and incoordination (fig. 13). Death follows a period of coma. Some females, although apparently starving, fill their mouths with feed but do not swallow it.

The carcass is extremely thin: there is almost no body fat. A yellow, easily torn liver is often observed. Usually the gall bladder is distended with bile—evidence the animal has not been eating—and the stomach is empty.

Ranchers have considered prevention of this condition a management problem. Watch nursing females carefully. If any becomes thin and dehydrated, give its kits to another female if they are too small to wean. Another help is to make food and water easily available to young kits from an early age onward.

Dr. G. R. Hartsough, of the Great Lakes Ranch Service, has observed that nursing sickness may result from a depletion of salt in the diet. He has recommended the addition of 0.5 percent of table salt to the mixed feed from late May until the middle of July. Some commercial mink cereals contain salt; therefore, use caution when

adding more salt, as minks are susceptible to salt poisoning.

### **Pregnancy Disease**

Pregnancy toxemia usually occurs a few days before whelping. Although the cause is not clearly understood, it may be nutritional. The disease is often a serious problem and causes losses of unborn kits as well as females. Additional fresh liver in the ration may help prevent the condition. The only characteristic post-mortem change is a yellow liver.

### **Urinary Incontinence (Wet Belly)**

Urinary incontinence, usually called wet belly, is common in minks in the United States. The cause is unknown. Constant dribbling of urine causes loss of hair and severe inflammation of the skin and underlying tissues in the region of the penis. Frequently 10 percent of the males on a ranch are affected.

When the animal is pelted and the skin is stretched on the board to dry, the damaged area is readily visible (fig. 14). Because these pelts bring lower prices at auction, the condition is cause for concern.

The condition has been successfully treated by increasing the amount of carbohydrate in the diet. The animals should have plenty of water.



FIGURE 14.—Mink pelts showing damage (dark triangular area) caused by wet belly.

### **Chastek's Paralysis**

Chastek's paralysis is so-named because the cause of the disease was discovered on the Chastek fur farm in Glencoe, Minn. Raw fish in the ration was causing paralysis and death in foxes on the Chastek farm. Research workers discovered that the raw fish contained an enzyme that caused the destruction of vitamin B<sub>1</sub> (thiamine). Daily feeding of fish that contain this destructive enzyme to either foxes or minks deprives the animals of all sources of thiamine. Reserves of the vitamin are soon used up. Minks refuse to eat and become very thin; paralysis and coma precede death.

Carp, suckers, saugers, goldfish, burbot, white bass, whitefish, creek chub, ocean herring, bullheads, and channel cats contain this enzyme. In experiments at Oregon State College, Chastek's paralysis was produced in minks and foxes by feeding them rations composed of 50 percent of fresh-frozen smelts.

To prevent the disease, remove all raw fish from the ration, feed raw fish on alternate days only, or cook the fish to destroy the enzyme. Include ample amounts of brewer's yeast in the ration.

In an outbreak, immediately remove uncooked fish from the ration. A veterinarian may recommend intraperitoneal injections of thiamine to treat the paralysis.

### **Gastroenteritis**

Gastroenteritis (inflammation of the stomach and intestines) has been produced in minks in experimental studies by feeding rations that lacked the factors found in fresh liver and raw milk. Weakness, loss of appetite, and bloody diarrhea are signs of the disease. The cause of black droppings, commonly mentioned by mink ranchers, may be poor nutrition. Addition of tomato pomace and fresh liver to the ration has alleviated the trouble on some ranches. Nutritional enteri-

tis may be more common than has been believed.

### Fatty Change of Liver

Fatty change of the liver, often referred to as fatty degeneration, is frequently found on post-mortem examination of minks. It is an abnormal change that accompanies many disease conditions rather than a separate disease. Accumulation of fat in the cells of the liver causes it to be yellowish or clay colored. It may be softer than usual, and it has a tendency to separate into small pieces. When the liver is cut with a cold knife, a film of grease remains on the blade.

Fatty change of the liver (fig. 15) is common in intoxications resulting from bacterial toxins, toxic

products of metabolism, or chemical poisoning. It is also common in nursing sickness. The change can be produced experimentally by starvation and by including excessive fat in the ration. Significant fatty change of the liver is not found in either experimental or actual field cases of steatitis (yellow-fat disease).

The diagnostic value of fatty degeneration is limited, because it occurs in many disease conditions. Do not attempt to treat fatty change of the liver as such, but rather look for the actual cause to provide a sounder basis for therapy.

### Hereditary Diseases

#### Hydrocephalus

Hydrocephalus, also called water on the brain or bighead, occurs in mink kits soon after they are born. It is characterized by a great distention of the part of the skull that covers the brain (fig. 16). Many cases never become apparent because the affected kits die soon after birth and are eaten by the females. When the condition becomes established in the breeding stock, it is very serious and difficult to eliminate.

*Cause.*—Hydrocephalus is non-contagious and, so far as is known, is not caused by any nutritional factor, but is hereditary. In rare cases it is caused by accidents in development during the gestation period, under which circumstances it is not inherited.

*Signs.*—The affected kit is usually first noticed when animals in the litter are counted and examined after whelping. When the affected kit is picked up and the head is examined more carefully, the part of the skull housing the brain is seen to be greatly distended and fluctuates to the touch.

The underlying cause is an accumulation of fluid within the cavities (ventricles) of the brain. The

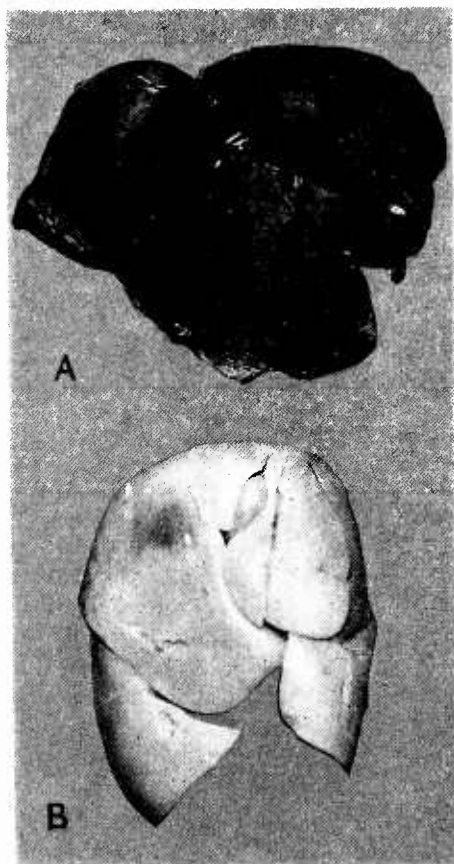


FIGURE 15.—A, Liver from a healthy mink; B, light-colored showing fatty change.



FIGURE 16.—Hydrocephalus in a mink kit; distended, softened skull revealed by removal of skin.

resulting pressure forces the brain substance against the soft developing bones of the skull, arching them outward. The pressure on the brain and the retention of fluid cause the dullness and muscular incoordination. Cutting open the swelling releases much colorless fluid and reveals a large cavity.

*Control.*—Hydrocephalus in minks is, in most cases, assumed to be a heritable lethal character produced by recessive genes. It may appear on a ranch as suddenly as a new color-phase mutation. Like other recessives, hydrocephalus may remain hidden for several generations, becoming apparent only when both male and female parents carry the hydrocephalic genes and transmit them to their offspring together.

If the malady appears, destroy the affected kit. It will only take nourishment from the female and die in a short time. Then pelt the sire, the dam, and the litter mates of the hydrocephalic kit. Both the sire and the dam are carrying the gene and all or most of the litter mates may carry it. These practi-

cal measures, if followed each year, should eliminate the trouble.

### Aleutian Disease

A condition causing death in adult minks that carry the Aleutian gene—that is, Aleutian and Sapphire color-phase mutations—results in many losses. The affected animal may exhibit bleeding at the mouth, become extremely thin, and succumb in a month or less. A marked increase in water consumption is a common sign. Nervous signs are also observed. The most striking finding at autopsy is an enlarged pale kidney with many small



FIGURE 17.—Kidney from a mink affected by Aleutian disease; note the many small dark hemorrhages.

hemorrhages (fig. 17). To increase the hardness of this beautiful mutation, many ranchers outcross them with standard black minks. However, such a breeding program results in “byproduct” minks having a lower pelt value. No effective treatment is yet known.

### Poisoning, Vices, and Miscellaneous Agents

#### Lead Poisoning

Each year a few mink ranchers suffer disastrous losses from red lead poisoning. Although it is a good preservative, red lead or any paint containing lead should never be used on wire, water and feed

dishes, or on any other equipment with which minks may come in contact. A little red lead paint on a wire-bottom pen, for instance, can cause the death of healthy minks.

*Signs and autopsy findings.*—Acute lead poisoning occurs when minks are placed on wire immediately after it has been painted with red lead in oil. For 2 or 3 days the animals appear normal, but soon they act sluggish and show no interest in their feed. These signs are followed by muscular incoordination, stiffness, trembling, complete loss of appetite, dehydration (removal of water from the body), and mucopurulent discharge around the eyes. About a week after they are placed in painted pens, the animals have a terminal convulsion and die.

Wire treated with red lead causes chronic lead poisoning in minks placed on it even when it is thoroughly dry. Wire-bottom pens may be dangerous for some time after they have been painted.

Minks with chronic lead poisoning show no characteristic signs. The animals lose weight gradually and die in 25 to 40 days. An autopsy reveals no characteristic changes. Diagnosis, therefore, must be based on the report that the animals had been kept on wire that had been treated with red lead.

*Treatment.*—When a diagnosis of lead poisoning is made, remove the animals from the painted pens as soon as possible. While in the pens the minks consume a small amount of lead each day from chewing on the wire or other painted equipment.

Give the survivors adequate amounts of calcium in their ration each day. This may be in the form of dicalcium phosphate or calcium gluconate, obtainable from a veterinarian.

Treat animals for at least 2 months, gradually reducing the dosage. At the same time feed enough fresh fish oil to supply vitamin D.

The calcium and vitamin D tend to prevent the lead from circulating in the system and to store it in the bones, where it will do little harm. After it is stored in the bones, it is slowly eliminated from the body.

## Other Poisoning

Many materials can poison minks. Because the animals are confined in a small space, the major possibilities are poisoning from materials sprayed on them or the pens, and poisoning from some toxic material in the feed. Poisonous spray materials include DDT, creosote, sulfur, chlorinated phenols and benzol benzoate compounds. Poisonous material may be mistaken for a feed ingredient and added to the ration. For example, commercial fertilizer may be mistaken for bonemeal.

## Feeding Poultry Waste

Breeding failures on many mink ranches have been attributed to the feeding of poultry waste containing the heads of chemically caponized birds, known as caponettes in some localities. The chemical—a hormone-producing drug, diethylstilbestrol—is implanted as a pellet in the neck of the bird a few weeks before it is to be marketed. The pellet gives the same results as surgical caponization and is more convenient.

Apparently, when the heads of caponettes are fed to minks, enough of the pellet remains to interfere with reproduction and cause breeding failures in both males and females. Ranchers who must feed poultry heads as a source of meat should be positive that they do not include caponette heads in the diet.

## Foreign Bodies

It is not uncommon for a mink to get small bone splinters stuck in the corners of its jaw in such a manner that it is unable to close its mouth. When fed ground turkey or chicken heads, a mink may get one of the small rings of windpipe encircled

and lodged around its tongue. The signs are similar in both cases. The animal seems hungry but refuses to eat. Saliva collects at the corners of its mouth, and the mink scratches at its mouth. The mouth should be opened and the bone or ring of cartilage removed. Ranchers can often prevent further trouble of this kind by using feed-grinder plates with smaller holes.

Minks occasionally consume quantities of bedding, splinters of wood, or such other materials as pine needles. This depraved appetite often leads to impactions or perforations of stomach and intestine.

### **Tail Chewing and Fur Clipping**

Nothing disgusts mink ranchers more than an animal that chews its tail or clips its fur. Fur journals contain many suggestions from ranchers and veterinarians on how to cure or prevent this vice. One method may be successful in some cases but not in others. Undoubtedly, close confinement and an inadequate ration predispose to tail chewing and fur clipping. Few trappers have found wild minks that mutilate themselves in such a manner.

Fur clippers chew off all the hair they can reach. This gives them a lionlike appearance (fig. 18). Strangely, few animals show any ill effects from their diet of hair. They

often stop chewing their hair for a month or two. If they ever get a full prime coat, it is well to pelt these animals, as they may begin chewing again at any time. A tail chewer first sucks its tail, much as a child sucks its thumb. Soon it begins to chew the flesh and bone. It is not uncommon for a mink to chew off its entire tail and continue chewing until death results.

### **Heat Exhaustion**

Heat exhaustion is a paralysis of the mink's heat-regulating mechanism, caused by prolonged exposure to excessive heat either from the sun or from confinement in a close, hot place. Losses may be very high when the females are whelping or when the kits are only a few days old if they are housed in humid, poorly ventilated pens. Free movement of air reduces the danger considerably.

Excessive heat affects the female at whelping time. She may not take care of her kits, or she may maul and drag them from the nest box out onto the wire, where they may be killed by the direct rays of the sun or they may fall through the wire and be lost.

*Signs and autopsy findings.*—If the female is whelping and the weather is excessively hot and humid with no air currents, the young kits may die so rapidly that no signs can be observed. The female does not clean them properly and is in distress herself. She may lie in the doorway of the nest box, shutting off any air currents that might otherwise enter. The nest box then becomes exceedingly hot and the kits suffocate.

On a hot, humid day later in the season, when the kits are older, the rancher may find some kits dead and others affected. These older animals, however, usually show typical signs.



FIGURE 18.—Marked fur chewing by a Silver Blue male mink.



FIGURE 19.—Young mink kit showing signs of heat exhaustion. It is unable to move rapidly; when disturbed it will turn on its side and cry weakly.

First the older kits become quiet and stretch out on their sides. As the day progresses and becomes hotter and more humid, they look anxiously for shade and water. If the rancher reaches for a kit at this time, it may turn on its side and cry weakly in protest (fig. 19). The kits appear extremely nervous and bite at the wire. They breathe rapidly and must crawl on their stomachs to move. Saliva soon gathers at the corners of their mouths, and the animals may have a terminal convulsion or go directly into a coma and die. This chain of signs may occur in a surprisingly short time.

At autopsy, the lesions are often indefinite. However, a marked congestion of the lungs is usually found. The large veins are often distended, and the blood fails to clot. Small hemorrhages are occasionally seen on the thymus gland. Since the carcass is hot, decomposition is rapid.

*Treatment and prevention.*—Unfortunately, not much can be done to help a kit at whelping time. Older kits can sometimes be revived by dipping them in lukewarm water. After dipping, place them in the shade, where there is free

circulation of air. As a stimulant in advanced cases, place a drop or two of aromatic spirits of ammonia on the tongue.

Frequent watering—as often as 10 times a day during hot, humid weather—is a preventive.

Large lawn sprinklers aid in cooling a small yard. Overhead pipe sprinklers, such as those used in nurseries, can be placed in yards where large numbers of minks are held. When sprinkling, do not allow any of the cold water to fall on the young kits; the sudden shock might kill them.

Many ranchers find aluminum-roofed sheds very satisfactory. They are durable and fairly cheap, and they are relatively cool on the hottest days. The aluminum sheeting reflects the heat. If the sheds are built in a north and south direction, check closely to see that the sun, as it passes overhead, does not reflect off one slanting roof onto the young kits in the shed parallel to it. With a certain pitch of the roof this may occur. To block the reflection, put canvas shades or sacks on the side of the shed.

Some mink ranchers lay burlap bags on the wire and wet them down. Evaporation of the water helps to keep the pen cool. The lid of the nest box can be opened and the hay removed to help the circulation of air.

### Posterior Paralysis

This disease is characterized by a sudden posterior paralysis. The mink moves about with its front legs dragging its rear quarters. There is loss of control of urinary function. The appetite remains surprisingly good. The actual cause is unknown; however, spinal injuries are suspected. The number of animals affected on a ranch seldom exceeds  $\frac{1}{2}$  of 1 percent; nevertheless, it is an annoying condition. Treatment has not been successful.



## PARASITES OF MINKS <sup>2</sup>

Minks are susceptible to a number of insect and worm parasites. Only a few are of great economic importance at present. However, those not now important may become so if methods of feeding, handling, and housing minks are changed. Furthermore, some of the parasites now found only in wild minks might cause grave concern if they become established in ranch-raised minks.

Keep recently purchased animals in quarantine for a few days and check them for parasites. Whether or not a living animal is infected with internal parasites can usually be determined by microscopic examination of the manure for worm eggs and protozoan cysts (p. 31).

### Prevention and Control

For profitable mink ranching, parasite prevention is necessary. The best preventive measures are good sanitation, good housing, good feeding, and a knowledge of the potential parasites and their life cycles.

On ranches where good husbandry is the rule, minks are rarely infested with parasites. Ranchers who practice good sanitation and hygiene may never experience an outbreak of coccidiosis or a flea infestation. Modern pens are so constructed that they can be kept clean and free of infective forms of parasites.

Few remedies for the removal of internal parasites of minks are either safe or effective. To remove worms, drugs must be powerful. They are not easy to administer to minks. Prevention of infection with parasites is far preferable to treatment. Supply feed from reliable sources, remove manure fre-

quently, use proper disinfectants when necessary, flyproof nest boxes, and use wire-bottom pens and sanitary water containers.

### External Parasites

Fur animals frequently become infested with the larvae—maggots or grubs—of flies. Older animals are rarely infested; young kits, sometimes those only 1 week old, are the more frequent victims.

*Fly control on the ranch.*—To reduce the number of house flies, blowflies, and their maggots around the ranch, control is directed toward preventing them from breeding. House flies are attracted by manure and other decaying vegetable matter. Flesh flies, bluebottles, and greenbottle flies are attracted by decaying animal material. They lay their eggs on carrion and on animals having soiled areas around body openings and infected wounds. Such maggot-infested areas should be cleaned up and washed with a mild disinfectant. If not treated, the animals may die.

Sanitation continues to be the most important consideration in any fly-control program. Removal and disposal of manure, waste feed, garbage, and decaying meat should be carried out routinely. Feed preparation rooms should be screened and kept scrupulously clean at all times. Insecticides and fly repellants should be used *with caution* around the ranch. Do not use them on animals, on feed and watering equipment, or on surfaces that the minks contact.

Eliminate breeding places and destroy adult flies and maggots around buildings by using fly sprays that have a residual killing action.

In addition to sanitation, the judicious use of insecticides around the premises and exterior of animal

<sup>2</sup> Prepared by H. J. Griffiths, professor of veterinary parasitology, University of Minnesota.

quarters should assist in the control of these flies. DDT, methoxychlor, and lindane applied as 2- to 5-percent wet sprays on wood or other surfaces, including vegetation, provide long-lasting residual action. Do not spray the interior of animal quarters and do not apply on minks, or contaminate their feed or water with these insecticides. Dry or wet poison baits are effective in controlling house flies and some kinds of blowflies. Baits may be scattered or sprinkled or painted around the premises where flies congregate. The poison baits consist of organic-phosphorus insecticides, such as Malathion, Diazinon, and Dipterex, to which a sweetening agent has been added. Manure and garbage piles can be treated with Diazinon or Malathion sprays to destroy maggots. These meas-

ures should assist in general fly control.

### The Fox Maggot

The fox maggot (*Wohlfahrtia* spp.) is widely distributed throughout the Northern United States. It probably causes greater annoyance and loss of mink kits than any other maggot-producing fly. Kits are most frequently attacked by it when they are about 5 weeks old.

The fly responsible for this maggot invasion of kits is about twice the size of the ordinary house fly. It is black and gray and rather slow in its movements. Adults feed on such sweet materials as nectar of flowers, especially that of sweet clover. The female fly strikes at various parts of her victim, but she seems to prefer the face, neck, flank, and areas around the natural body openings. Once she finds a suit-

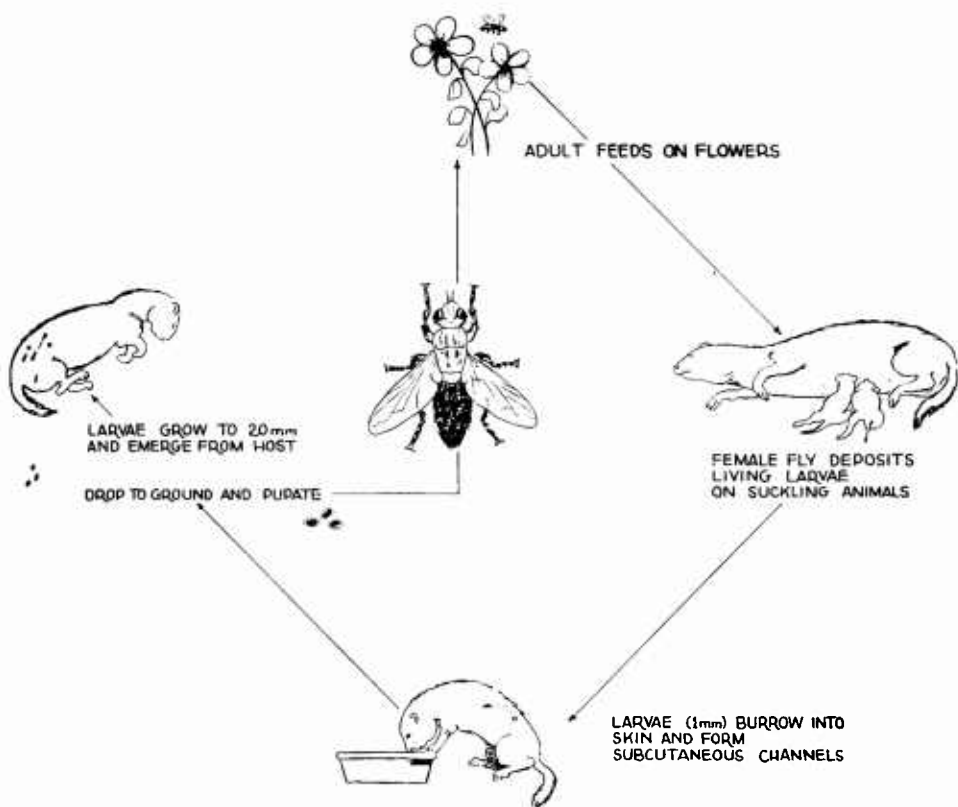


FIGURE 20.—Life cycle of the gray flesh fly.

able spot she deposits minute maggots, which attempt to bore into the skin. Usually they are not able to penetrate the skin of the adult but readily break through the skin of the newborn kit (fig. 20).

Once they have penetrated the skin, the maggots develop rapidly and in 3 or 4 days may attain a length of about half an inch. They remain under the skin for 9 to 14 days. Then they leave the mink and fall to the ground. Here they go into the resting (pupal) stage, and in due course become adult flies. The life cycle may be completed in a month during warm weather and under the most favorable conditions, or it may be prolonged for 7 to 8 months if it began in the fall.

The gray flesh fly is abundant from June to September, the period of greatest attack usually being in June. Late-born litters are more likely to become infested than earlier litters.

*Signs.*—A small area at the point of the maggots' penetration becomes reddish. Serum seeps from the irritated area, and the surrounding fine fur becomes matted. As the maggots grow, a boillike lesion develops. This lesion has a small opening through which the maggots obtain air (fig. 21).

While skin penetration is in progress, the young minks become extremely restless and may whine pitifully. The nursing mother often drags them outside the nest box, where they may die from exposure. The constant irritation, restlessness, and lack of appetite brought about by this maggot infestation may result in exhaustion and emaciation of the kits; death may occur.

*Treatment.*—Although many ranchers do not like to handle kits until they are weaned, examination of the kits every second day is necessary to control this pest. This examination entails considerable labor, but it is the most effective



FIGURE 21.—Taking a flesh fly maggot from a hole in a mink kit's skin.

method of reducing losses from the fly.

*Prevention.*—To prevent the infestation of mink kits with the gray flesh fly, screen the entire shed. Screening of individual pens is costly and impractical.

Keep lids of the nest box tightly closed. To provide adequate ventilation, remove a 2-inch strip of wood below the lid and replace it with a piece of fly screening. Brush the screen occasionally to keep it free from dust and lint. Fly traps around the pens may help in reducing the fly population.

### Grubs of the Rodent Botfly

The grubs of the rodent botfly (*Cuterebra* sp.), which frequently infest rabbits, squirrels, field mice, deer mice, several other rodents, and

domestic kittens, occasionally infest minks.

The adult fly is large and prefers to lay her eggs in dark surroundings. Little is known as to how the grubs that hatch from the eggs enter the skin of the host animal. Once under the skin, they grow to be  $\frac{3}{4}$  inch long and almost  $\frac{1}{2}$  inch in diameter. When full grown, the grubs leave the skin, drop to the ground, and later become adult flies.

The grubs do not seem to annoy the minks to any great extent while they are embedded beneath the skin. However, they may readily be removed by squeezing them out or by pulling them out with a pair of thumb forceps.

### Fleas and Lice

Minks are not commonly infested with fleas. When they are, however, they may suffer considerably. When foxes and minks are kept in the same enclosure, the common dog flea (*Ctenocephalides canis*) may appear on minks. Such an invasion is transient, however, for this flea prefers feeding on foxes.

The mink flea (*Ceratophyllus vison*), when present in large numbers, is very detrimental to the health of minks. As these insects feed on blood, they may produce a marked anemia and also cause the animals to become restless and gradually lose weight. Pelts may be damaged by continuous scratching and by the excreta from the fleas, which becomes intermingled with hair and skin excretions.

Lice on minks are rare. However, a biting louse (*Trichodectes retusus*) has attacked ranch-raised minks. When present, lice may be very annoying. They blemish pelts by attaching their eggs to hairs, and the irritation caused by the adults may result in loss of fur through rubbing and biting.

*Control.*—Fleas reproduce by laying eggs on an animal's body or in the dust and litter in the nest box. As the eggs are not sticky, those laid on the animal soon drop off into the bedding or litter. Flea control is aimed at killing the adult forms on the host, as well as the

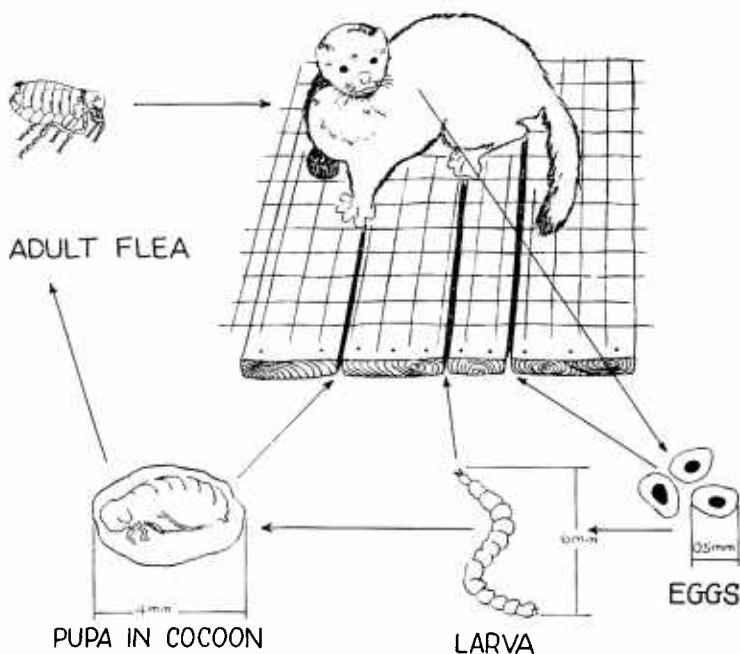


FIGURE 22.—Life cycle of the flea.

immature forms in the dirt, cracks, and crevices of nest boxes and kennels.

To destroy the young stages—eggs, larvae, and pupae (fig. 22)—remove all the litter and debris from the nest boxes and pens. Burn this material. Then scrub with hot water and lye; 1 pound of lye to 5½ gallons of water makes a suitable cleaning and disinfecting solution.

To destroy the adult fleas and lice, dust adult minks with a good insect powder. Commercial preparations of pyrethrum and rotenone are available in powder form. Dusting should be done over a sheet of paper that can be folded up and burned. Repeat dusting treatments 2 or 3 times at intervals of 2 weeks to destroy the young lice or fleas that hatch from eggs.

Using insecticidal powders and dusts on and around minks is dangerous. Do not use dusts in nesting hay or in nest boxes prior to whelping and do not dust kits until they are at least 8 weeks of age. Only insecticides that are relatively nontoxic, such as derris or pyrethrum, are recommended for this purpose.

### Mange

Mange is rare in minks. When found, it has usually been traced to the introduction of fitches or ferrets or to contamination of ranch equipment by infested fitches.

Mange mites (*Sarcoptes* sp.) are prolific. They burrow into the skin and they are minute; therefore, they are not readily visible to the unaided eye. Ordinarily, the disease they cause is not recognized until it has gained a good foothold. Infested areas become extremely itchy, whereupon the animals bite and scratch in an effort to get relief. Scabs form over the infested area, and the legs and feet, which frequently become infested early, become greatly enlarged and cov-

ered with brownish scabs and crusts.

If mange is suspected on a mink ranch, the diagnosis should be confirmed by microscopic examination. As mange is a serious contagious disease, consult a veterinarian whenever any animal has a scabby skin associated with itching. The diagnosis, control, and treatment should be undertaken under the direct supervision of a veterinarian.

### Other Mites

Occasionally, minks have been found infested with tyroglyphid and cheyletid mites. Though not usual parasites of minks, they may cause considerable fur damage. Tyroglyphid mites are usually found in stored foods, dried meats, grains, and flour and other cereals, but at times they may attack small animals or even man. Cheyletid mites may be free-living, but they also have been found on field or house mice and other small rodents, where they may be parasitic.

Sometimes these mites are brought to a mink ranch with food products and may be found by the millions in litter, bedding, or nest-box dust. When the mites get on minks, they cause considerable irritation. The minks seek relief by scratching and rubbing, which destroys the guard hairs on their sides and tails.

These mites may be controlled by scrupulous cleaning of pens and nest boxes. Transfer infested animals to clean quarters, remove all litter, and scrub dirty pens.

### Internal Parasites

#### Coccidia

Coccidiosis (a disease caused by coccidia, minute protozoan forms) may become rampant on mink ranches and cause heavy mortality among kits. The disease is most common in summer or early fall and appears to be equally prevalent in

dry and wet seasons. Although coccidiosis usually affects animals kept on earth and board flooring, it may also affect those kept on wire flooring. Before wire-bottom pens came into general use, losses among minks from coccidiosis were extensive. In the early days, this disease probably was one of the major single factors in kit mortality. Both ranch-raised and wild minks may become infected. Adult minks often act as carriers of coccidia and may be a source of infection for the kits even though they show no signs.

The parasite lives in the intestinal tract, and the infective forms (oocysts) are passed out with the manure. The oocysts develop further outside the body, and the animal becomes infected by swallowing them with contaminated feed and water. Once swallowed, the oocysts develop rapidly and liberate great numbers of tiny bodies.

These invade the cells of the gut wall, thereby producing much irritation and injury. The young parasites, in turn, produce oocysts that pass out with the droppings and repeat the life cycle within about 2 weeks (fig. 23).

*Signs.*—The severity of coccidiosis depends on the extent of infection and the mink's resistance. The signs, therefore, are not always clear-cut and specific. Usually the first sign noted is the passing of droppings coated with mucus. The appetite may become irregular and impaired; the fur, rough, lusterless, and frequently faded. Progressive weakness and loss of flesh usually follow. If the disease is associated with distemper or some other malady, losses may be great. Coccidiosis may also be chronic, especially in older animals. It runs its course in from 4 to 10 weeks, after which the animal will have built up an immunity. Us-

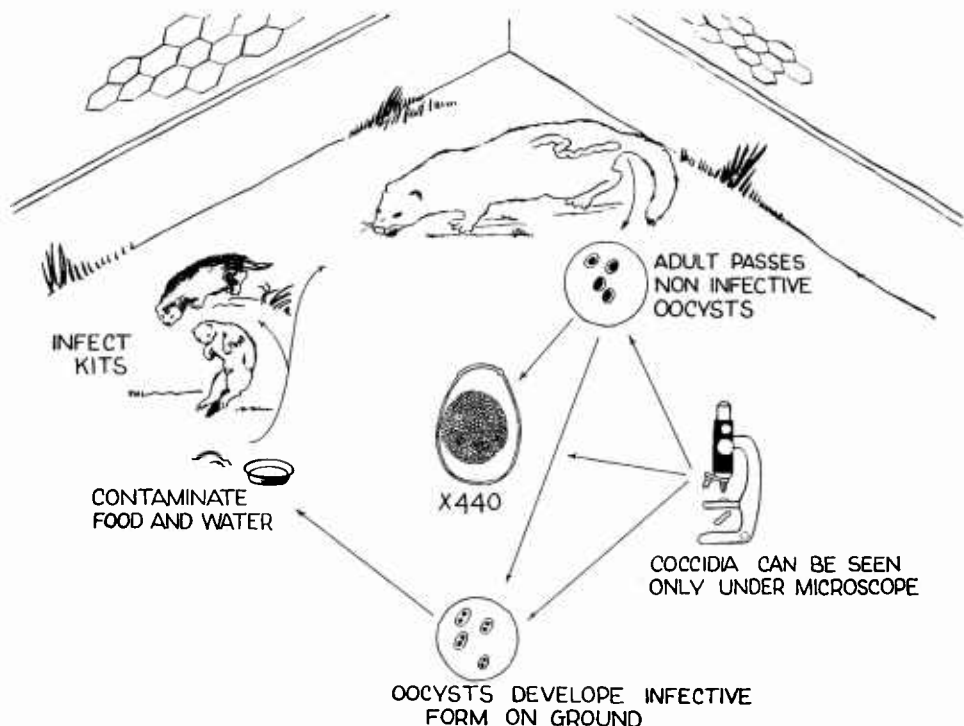


FIGURE 23.—Life cycle of coccidia.

ally an outbreak of coccidiosis runs its course and the losses cease without treatment.

**Prevention and treatment.**—As yet there is no remedy that controls coccidiosis. If the disease has not gained too great a foothold, good feed and nursing, together with good sanitation, may help greatly. Modern ranching methods and pen construction have aided in eliminating this disease. When minks are kept under insanitary conditions, reinfection is continuous. Use pens with suitable types of elevated wire floors and keep feed and water troughs scrupulously clean.

### Toxoplasma

Suspected outbreaks of toxoplasmosis have been observed in minks in Minnesota and Ontario. The disease may appear in the form of a nervous disturbance involving the brain. Affected minks may show extreme nervousness, irregular feed and water consumption, inability to find their food and to chew and swallow it in the usual manner. In advanced stages of the infection, severe nervous disorders may be seen prior to death.

At present there is no effective treatment for this protozoan infection. Transmission may be through eating infected meat, but this has not been proved.

### Roundworms of Digestive Tract

Generally speaking, ranch-raised minks are not seriously affected by roundworms, a hazard of the fox industry some years ago. Several species of roundworms from wild minks have been reported, but none appear to have caused serious losses in ranch-raised animals.

Ascarids, commonly present in the intestines of foxes and dogs, are seldom found in minks. However, animals infected with intestinal roundworms may show some diarrhea and intestinal disturbance.

A fine threadlike worm (*Capillaria* sp.) has been observed as an occasional intestinal parasite of minks, but the harm done by it has not been determined.

### Roundworms of Kidney

The kidney worm (*Dioctophyma renale*), commonly called the giant kidney worm (fig. 24), has been recorded from both wild and ranch-raised minks. It measures up to  $\frac{1}{4}$  inch in diameter and 12 inches in length and is reddish in color. Although the worm is usually found within the kidney, it has been found also free in the abdominal cavity. As a rule, only one kidney is affected and usually only one worm is present.

The life cycle of this worm is complicated. Its eggs passed in the urine are ingested and develop in small leechlike worms (branchiobdellid) that are parasitic on crayfish. The latter are eaten by bullheads which become infected by

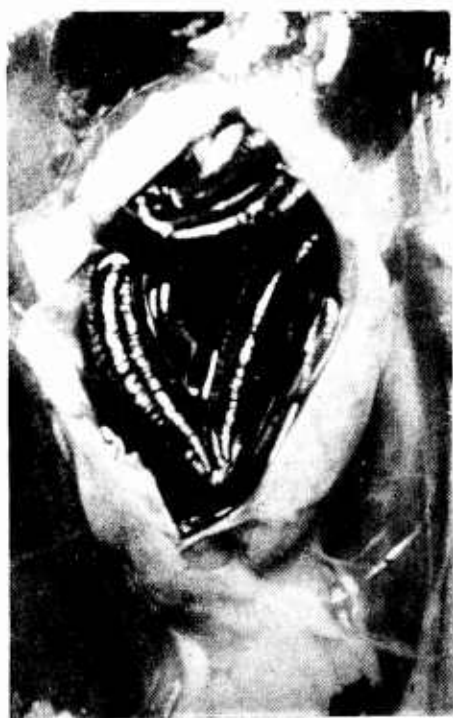


FIGURE 24.—Mink kidney cut open to show the giant kidney worm within.

ingestion of the branchiobdellid. Minks become infected by eating the encysted parasites in the bodies of the bullheads.

The presence of this worm in one kidney does not usually produce any signs. If both kidneys become infected, which is unusual, the animal dies. Because no curative treatment is known, control is based on prevention of infection. Bullheads suspected of coming from infected sources should be cooked before being used for mink feed.

### Trichinae

Trichinosis, a serious and often fatal human disease resulting from an infection with *Trichinella spiralis*, sometimes affects minks. Trichinae—small, slender worms—are acquired by eating raw meat containing encysted larvae. Infection may be prevented by thoroughly cooking meat and meat scraps fed to minks.

### Guinea Worms

Guinea worms (*Dracunculus insignis*), which infect dogs and foxes, have also been found in ranch-raised minks. This worm is an elongated, cylindrical, white nematode, ranging from 1 to 2 millimeters in width; the female ranges from 75 to 280 millimeters in length. The worms are found just under the skin. The female liberates a mass of living larvae through a small opening in the skin when the skin comes in contact with water. These young worms, free in the water, are swallowed by a water flea (*Cyclops* sp.), in which they develop further. Minks become infected by drinking water containing infective cyclops. This worm does not appear to cause much harm or inconvenience to its host. A closely related species is transmissible to man by way of contaminated water; hence, measures should be taken to destroy and dispose of infected animals.

### Tapeworms

Tapeworms of several kinds have been recorded, but they are not common in ranch-raised minks. They are found in the small intestine but do not appear to cause marked signs or lesions. The muskrat may act as an intermediate host for some tapeworms. Therefore, do not feed raw muskrat or muskrat livers to minks. Fish that show any bladderlike cysts in the muscle or other tissues should be thoroughly cooked before they are fed to minks.

### Lung Flukes (Flatworms)

As a rule, flukes are common in wild furbearers, especially those that live in and around lakes and marshes. Occasionally, flukes appear in ranch-raised minks, especially if they are fed raw fish, crayfish, frogs, or mice.

The lung fluke (*Paragonimus kellicotti*), although fairly common in the midwestern United States, is not likely to become established among ranch-raised animals because of its complicated life cycle. The fluke ranges in length from 4 to 16 millimeters and in width from 4 to 8 millimeters. The parasites live in cystlike cavities in the lungs. The cysts are relatively large and may appear on the lung surface as bluish raised areas. Cutting into the cysts may reveal one or more parasites bathed in a dark-brownish slimy fluid.

This fluke requires two intermediate hosts to complete its life cycle—the first a species of snail, the second a crayfish. Minks become parasitized by eating infected crayfish. If crayfish are used for mink feed, they should be boiled.

As this parasite inhabits the lungs, the usual sign is a cough. Heavy infections may cause death of the animal. No effective treatment is known.



## Intestinal Flukes

Several species of flukes, ranging in length from 1 to 3 millimeters, may be found in both wild and ranch-raised minks. Although they do not seem to be very harmful, infected animals may not do well, may show some diarrhea, and may have harsh, lusterless, dry pelts. The life cycle of each of these flukes requires one or more intermediate hosts; the second one usually is a fish, crayfish, or frog. Infection among ranch-raised minks may be prevented by cooking such feed or by subjecting it to prolonged freezing.

## Liver Flukes

A liver fluke (*Metorchis conjunctus*) occurs in both wild and ranch-raised minks. Some ranchers have suffered severe losses from this parasite which is found in the gall bladder and bile ducts. Signs are irregular appetite, general unthriftiness, weakness, jaundice, and anemia. No effective treatment is known. As the infective stage occurs in the common sucker, infection may be prevented by cooking this fish before feeding to minks.

## Examination of Feces for Parasite Eggs

If minks are not doing well and there is reason to suspect parasite infection, it is advisable to have a specimen of feces examined for parasite eggs or cysts. The presence of internal parasites in living animals can usually be determined by microscopic examination of fresh droppings. Most internal parasites produce large numbers of eggs within the host's intestine. Finding these eggs in the manure confirms the presence of the parasite in the animal. Whole worms or parts of them may occasionally be passed with the droppings and can sometimes be seen.

## Collection and Preparation of Samples

For a preliminary survey or routine check, collect composite samples of feces from the pens. Number each sample to correspond to the pen or animal number. Samples collected should be fresh; satisfactory and reliable results cannot be obtained with old, dried manure. Pick up the samples with a small wooden stick (fig. 25) or spoon. They should be as free as possible from material such as dirt, bedding, sand, and stones. To avoid contamination, use new sticks and separate containers for each sample. Examine the samples promptly. Many worm eggs and protozoan cysts develop quickly once passed to the outside in the manure. If examination must be delayed, keep the samples on ice or in a 10-percent formalin solution.

*Direct smear.*—The direct-smear method is the simplest and quickest way of preparing fecal material for examination for worm eggs. Moderate to heavy infections can be detected by this method; however, light infections may be overlooked. The minute parasite eggs can be seen only with the aid of a microscope.

Place a drop of clean water on a 3- by 1-inch glass slide. With a match or toothpick, take small bits of fecal material at random from several parts of the sample of droppings. Mix the fecal material with the drop of water with a rotary motion. Then place a clean cover glass over the preparation. The smear is now ready to be examined (fig. 26).

*Straining and sedimenting.*—Parasite eggs are easier to find if the coarse material of the fecal sample has been removed and if the eggs are concentrated. This may be accomplished by the process of straining and sedimenting. Mix the feces thoroughly with about a pint of water by shaking and stirring.

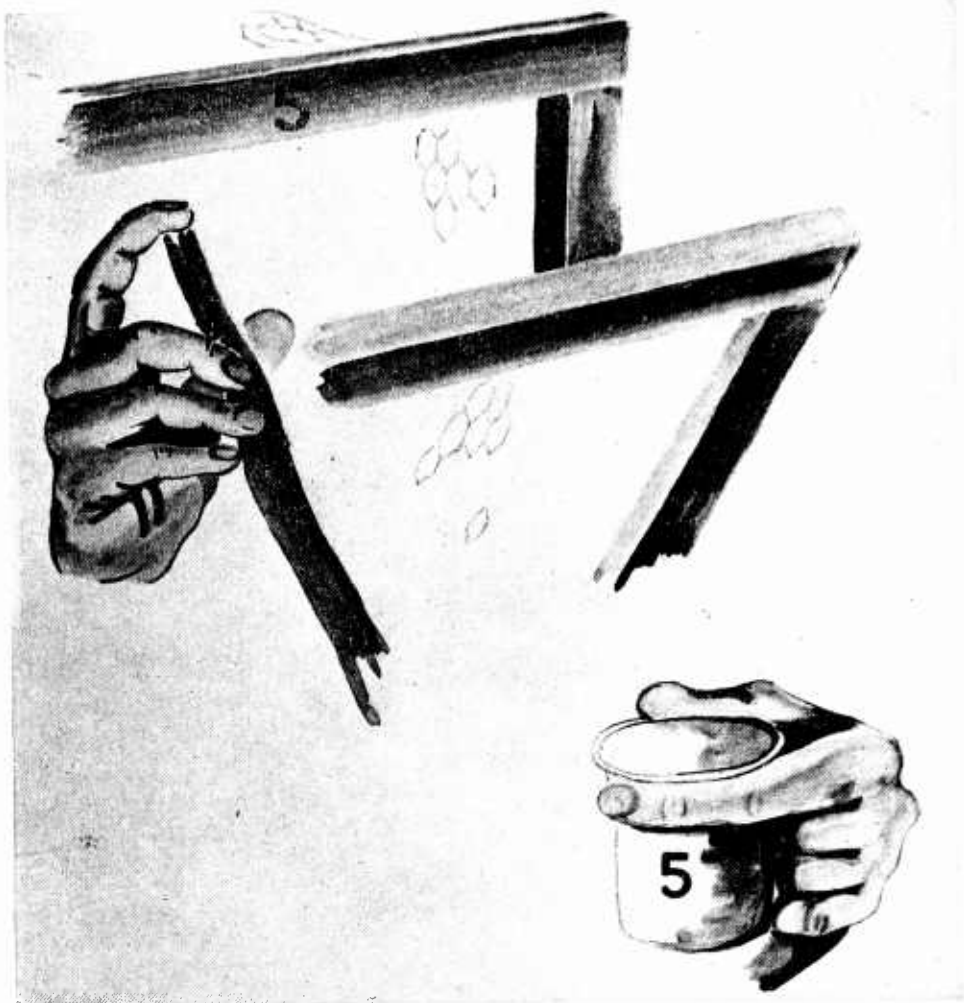


FIGURE 25.—Collecting with a stick a sample of manure (left) to be placed in container (lower right) labeled with the pen number (upper left).

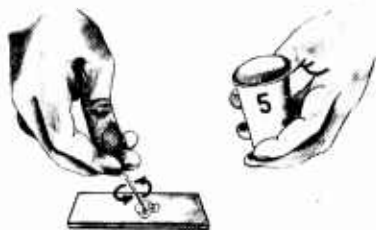
Then strain the mixture through a fine sieve, or one or two thicknesses of cheesecloth, to remove the coarse particles. The liquid which passes through the sieve will contain the parasite eggs. These will settle to the bottom of the jar in 15 to 20 minutes. With a small glass tube or a clean straw, transfer a drop or two of the sediment to a glass slide for examination under the microscope.

*Flotation method.*—Another method commonly used for separating worm eggs from coarse fecal material is to float them to the sur-

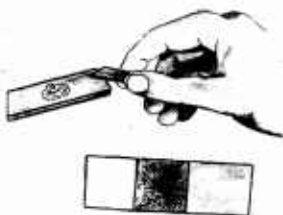
face of a fluid. Mix the feces with a liquid of such density that the eggs are lighter than the suspending fluid and hence float to the surface. Two fluids commonly used for the purpose are saturated salt solution and a sugar solution. The worm eggs will float to the top within 15 to 20 minutes and can then be removed with a wire loop or glass rod, transferred to a slide, and examined under the microscope. This method is excellent for certain roundworm eggs, but fluke eggs may fail to rise to the surface without rupturing.



1. Place drop of clean water on slide



2. Mix in small amount of sample



3. Place cover slip over material

FIGURE 26.—Preparing feces for examination of worm eggs by the direct-smear method.

### Examination of Slide

When the material is ready for examination, place the slide on the microscope stage and reduce the light so the transparent objects stand out clearly. Beginning at the upper right-hand corner of the cover glass, move the slide slowly back and forth from side to side; examine systematically until the

entire slide has been examined. The examination will reveal many structures that can be mistaken for parasite eggs or cysts. Compare the objects seen with drawings or photographs of the eggs. With practice, worm eggs and protozoan cysts may be readily identified; however, the personal aid of one acquainted with these eggs is of much help to the beginner.

## HOW TO PACK AND SHIP SPECIMENS FOR LABORATORY DIAGNOSIS

“Upon arrival, the carcass of your animal was decomposed and could not be used for examination. If available, we suggest you send additional animals.”

A veterinarian often has to send this statement to a rancher in answer to a serious problem. Much time is lost. Often by the time additional animals are received, properly packed, it is too late to stop further losses. A satisfactory post-mortem examination cannot be per-

formed on a decomposed animal because signs of disease that may have been present are often changed or entirely obscured.

The best way for a rancher to obtain an accurate diagnosis is to take the dead animals, or 2 or 3 sick animals showing typical signs, to the nearest laboratory. Then he can supply any additional information the pathologist may need. If this is not convenient, the dead animals may be shipped.

## Shipping Dead Animals

If the carcass is to be shipped a short distance, chill it thoroughly and place it in the center of a box containing sawdust or shavings (fig. 27). For long-distance shipments, place dry ice around the carcass, then pack it as indicated above. Never put dry ice in an airtight jar or can. When the ice melts, gas is formed; if the gas cannot escape, it may cause an explosion. Properly used, dry ice will prevent spoilage for 2 or 3 days.

If dry ice is not available, place the animal in a can with a tight lid (1- or 2-pound coffee cans are a convenient size for minis), freeze solid, and pack in crushed ice surrounded by sawdust to take up the water. A

wooden box can be used for shipment, but if a bucket, such as a lard container, can be substituted for a wooden box, no sawdust is necessary.

Many specimens decompose after arriving at the laboratory because no one is available to take care of them promptly. With this in mind, do not send fresh specimens that will arrive on a weekend; most laboratories do not operate on Saturday or Sunday. Address the package to the laboratory itself, not to an individual employee. This will insure more immediate attention.

Do not send carcasses that have started to decompose. It is better to kill an animal or two that show typical signs, or to ship them alive



FIGURE 27.—Packing a dead animal to be shipped a short distance. The carcass, thoroughly chilled, is placed in the center of a box containing sawdust or shavings.

if there is a chance that they may reach their destination before death.

## The Accompanying Letter

Letters that do not contain sufficient information are a problem to the pathologist. In some diseases, a complete history is more useful than the carcass. The autopsy of an animal affected by Chastek's paralysis or botulism, for example, will show little. The accompanying letter should contain the following information:

- (1) Number of minks on the ranch.
- (2) Number of animals showing signs; age of animals affected.
- (3) Number dead.
- (4) Dates of first losses and subsequent losses.
- (5) Description and duration of signs before death.
- (6) Feeding schedule for past 6 months.
- (7) If the animal has been pelted, give color of the pelt, condition of the eyes (whether or not a discharge was present), and condition of the coat and foot pads.
- (8) Incidence of infection (whether it is in just one house or pen, among one type of mutation, or scattered throughout the ranch).
- (9) What treatment, if any, has been given.
- (10) Type of housing (whether the minks are kept on wire or in ground pens).
- (11) Any other information that might help explain the outbreak.

As it is against postal regulations to send frozen carcasses of diseased fur animals through the mail, shipment must be made by rail or air express. Place the written material inside the package. If cracked ice is used, place the letter where it cannot become soaked and illegible. Label the outside of the box, "Biological Specimen," "Rush," and "Keep in a Cool Place."

## Shipping Tissues in Formalin

Sending tissues or organs in a preservative such as 10-percent formalin is often helpful in making a diagnosis. This solution may be obtained from a local veterinarian or druggist. Send the whole bladder and brain, but only a piece of the kidney, spleen, liver, lung, stomach, and intestine. These pieces should be about the size of a postage stamp and a quarter of an inch thick. Use of 10-percent formalin has the disadvantage that it kills any bacteria or virus present. Therefore, bacterial studies or viral inoculations cannot be made from tissue thus packed.

## Shipping Parasites

Ship fleas, lice, flies, maggots, mange mites, and internal parasites for identification in a clean tight bottle (fig. 28) containing 70-per-



FIGURE 28.—Placing parasites to be submitted for identification in a stout glass jar containing 70-percent alcohol. The jar can then be wrapped in absorbent cotton and packed in a strong box or mailing tube.

cent alcohol, obtainable from a local veterinarian or druggist. Do not allow the parasites to dry out before mailing, and always put them in a preserving fluid. If the animals' feces are to be checked for parasite eggs, place a small amount in 10-percent formalin. Number each sample and put it in a clean jar.

Tissues and feces in 10-percent formalin, or parasites in 70-percent alcohol, may be sent by domestic

mail. Postal regulations require that they be placed in stout glass jars not more than 3 inches in diameter with tight-fitting lids. Wrap the jars in absorbent cotton

or other suitable absorbent material in sufficient quantity to absorb all the fluid in case of breakage, and then pack them in strong boxes or mailing tubes.